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FAO Plant Protection Bulletin

Vol. I, No. 12 A Publication of the September, 1953

World Reporting Service on Plant Diseases and Pests

Plant Diseases in British Colonial Dependencies: a Half Yearly Report

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Africa

Tanganyika Territory

Panama disease of bananas (*Fusarium oxysporum* f. *cubense* (E. F. Sm.) Snyder & Hansen, first recorded in 1951 in the Moshi District, has spread during 1952 to the Pare District; suspected cases in Korogwe and Muhesa areas await confirmation. The spread of the disease was restricted by the dry weather of 1952 and by the routine destruction of infected plants, using hormone weedkillers injected into the plants by a modified sheep drenching pistol, or applied by a modified knapsack sprayer.

Banana leaf spot (*Cordana musae* (Zimm). von Höhn.) was found for the first time in 1952 near Muhesa.

Maize rust (*Puccinia polysora* Underw.) was reported for the first time from Moshi, Kilosa, Muhesa, and Tanga Districts and probably occurs elsewhere. No serious loss has occurred so far.

Damage to rice due to birds sucking the florets when the grain is in the milk stage results in a white deposit resembling fungus spores on the outside of the glumes which are almost or completely empty.

Bacterial blight of peas (*Pseudomonas pisi* Sackett) spread to Iringa and Mbeya but was restricted by the dry weather.

Other new records include *Botryosphaeria ribis* Grossenb. & Duggar on apple causing canker; *Curvularia lunata* (Wakker) Boedijn in cultures from banana rhizome tissue; *Fusarium solani* (Mart.) App. & Wr. on sisal associated with a dark brown to black rot at the base of the spike and spreading into the bole, probably introduced by weevils; *Pseudomonas syringae* van Hall on lucerne causing a leaf spot, and? *P. glycinea* Coerper on lima bean (previously referred to *P. syringae*).

Northern Rhodesia

Only one disease has been reported as causing serious damage, namely anthracnose of tobacco seedlings (*Colletotrichum tabacum* Böning). Maize rust (*Puccinia polysora*) has been confirmed but no serious damage has occurred yet.

Mauritius

Chlorotic streak disease of sugar cane is widespread in the central plateau of the Island, where climatic conditions maintain a constant high degree of humidity of the soil. It also occurs at isolated spots of the coastal belt where the water table is so near the surface as to maintain a similar condition of the soil. The cane variety M. 134/32, extensively grown in the Island, is commercially resistant to its effects, but some rather severe losses are being experienced in the upper regions of the Island where the cane variety E. 1/37, which has greater susceptibility to the disease than M. 134/32, has recently been planted on a large scale.

Maize rust, *Puccinia polysora*, appeared in March 1953 for the first time in the Island, causing very severe damage.

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Seychelles

Little leaf and gumming diseases of coconut caused some damage in the past but are now of no importance. Coconut bud rot, of unknown etiology, occurs but is of no economic importance.

Vanilla at one time suffered from a widespread root disease caused by *Botryosphaeria vanillae* (Stonem.) Petch & Ragun. (= *Calospora vanillae* Mass.) but the vanilla plantations are now relegated to the drier parts of the island where the disease is not so prevalent.

Cassava mosaic is sometimes harmful but not seriously.

Cabbage black rot (*Xanthomonas campestris* (Pammel) Dowson) is successfully controlled by seed disinfection.

Asia

Hong Kong

No plant pathologist is stationed at Hong Kong but the following diseases have been reported by the agricultural staff, though the identity of the pathogens has not been confirmed.

Banana freckle (*Macrophoma musarum* (Cook) Berl. & Vogl.); citrus scab (*Elsinoe fawcetti* Bitanc. & Jenk.); citrus canker (*Xanthomonas citri* (Hasse) Dowson); citrus black spot (*Phoma citricarpa* McAlp.); papaw scab and anthracnose (? *Colletotricum gloeosporioides* (Penz.) Sacc.); peach shot hole (*Clasterosporium carpophilum* (Lev.) Aderh.); peach rust (*Puccinia pruni-spinosae* Pers.); and sooty moulds on citrus, guava, and persimmon.

West Indies

St. Vincent

No new diseases were reported but cotton wilt (*Fusarium oxysporum* f. *vasinfectum* (Atk.) Snyder & Hansen) is causing some apprehension, affecting plants in scattered plots throughout the Island.

Bahamas

No serious outbreaks of diseases occurred during the year but the following were reported: the "unknown disease" of coconuts; nut disease of coconut caused possibly by *Phytophthora* sp., and characterized by the extensive growth cracks on the surface of the fruit; and downy mildew (*Pseudoperonospora cubensis* (Berk. & Curt.) Rostov.) on cucumber and cantaloupe.

Jamaica

Little potato or premature tuberation of unknown etiology was reported for the first time. The seed was planted about the middle of November, a month earlier than usual. Potato blight (*Phytophthora infestans* (Mont.) D By.) was largely controlled by spraying.

Grenada

No serious outbreak of any disease occurred during the period ending 30th June, 1953. Some measure of success is being achieved in the control of witches' broom of cacao (*Marasmius perniciosus* Stahel), two surveys involving the inspection of 33,000 acres of cacao being carried out.

A Survey of the Newer Insecticides [1]

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SINCE the introduction of DDT, the number of chemicals available or suggested for use in insect control has become bewildering. The simplest classification of these insecticides is on a chemical basis though this involves an excursion into territory not too familiar to the biologist.

Chlorinated Hydrocarbons

The first group to be considered is that of the chlorinated hydrocarbons, of which **DDT** is the best known member. The famous Swiss firm of chemical manufacturers, J. R. Geigy, S. A., protected their discovery of the insecticidal activity of DDT by patents; hence an incentive to other manufacturers has been to discover insecticidal compounds not covered by these patents. Moreover, DDT suffers disadvantages, one of the most serious being that although of low acute toxicity to man and stock, it is suspected that the continued ingestion of low amounts may do harm. This indeterminate hazard becomes of consequence for DDT is, in common with other highly chlorinated compounds, comparatively stable and survives digestion to become stored in the body fat and to be excreted in the milk fat. For some as yet unknown reason, **methoxychlor**, which is the analogue of DDT in which the two nuclear chlorine atoms are replaced by methoxy ($-OCH_3$) groups, is not detected in the milk fat and it is, therefore, used in place of DDT where, as in dairies and cow sheds, this particular hazard is to be avoided. Like DDT, methoxychlor has a high potency to a broad range of insects, their relative toxicities varying according to species. A general toxicity to insects of all kinds, whether pests, pollinators or predators, can be a defect and where a more selective insecticide is needed DDD may find use. Chemically, **DDD** is the dichloroethane corresponding to DDT and in the latter abbreviation T stands for trichloroethane. A more recent introduction is again a dichloroethane but in which the nuclear chlorine atoms of DDD are replaced by ethyl groups, giving diethylphenyl dichloroethane. This compound, under the trade name "**Perthane**" or the code number Q137, has been suggested for trial where an insecticide of less general toxicity to insects than DDT is required.

Another well-known member of the chlorinated hydrocarbon series is benzene hexachloride, at one time called "666" because its chemical formula is $C_6H_6Cl_6$, but now known by its initials **BHC**, or **HCH** (hexachlorocyclohexane). This substance is made by the chlorination of benzene, a process which yields a mixture of isomeric compounds all of the above formula but differing in the spacial distribution of the hydrogen and chlorine atoms. BHC has a musty smell which precludes its use in dwellings or food stores but fortunately the active isomer has little smell and is now available commercially under the common name of **lindane**. Being slightly more volatile and heat-stable than DDT, lindane is nowadays the insecticide generally used in thermo-vaporizers for fly control in commercial and industrial premises or in similar food-free locations where man is working for only limited periods.

The chlorination of certain of the terpenes gives rise, as in the case of benzene, to highly chlorinated compounds such as **toxaphene** and a new insecticide introduced under the trade-name "**Strobane**". In both materials the exact chemical nature of the effective insecticides is unknown. Up to now toxaphene has found greater use in agriculture, against the insect pests of crops and of stock, than for domestic purposes.

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[1] Contribution No. 23, Science Service Laboratory, Department of Agriculture, University Western Ontario Sub P. O., London, Ontario.

A remarkable range of insecticides was discovered in the laboratories of the Velsicol Corporation. In this series the intermediate is produced by the chlorination of cyclopentadiene, a hitherto almost useless product of coal carbonization. The chlorination of the condensation product of this intermediate with cyclopentadiene itself gives rise to **chlordane,** known earlier as Velsicol 1068, a number indicating the formula $C_{10}H_6Cl_8$ of the main component. A modification of this manufacturing process gives a compound containing only seven chlorine atoms, which is therefore known as **heptachlor.** Both chlordane and heptachlor now find their widest use in agriculture for both are suspected of being hazardous to the health of animals after long exposures; both are, however, also widely used for those methods of fly and mosquito control which do not involve a continuous exposure of human beings to these chemicals.

The condensation reaction used in the manufacture of chlordane is the curious chemical reaction now known as Diels–Alder reaction after the two chemists who first studied it in detail, work which earned for them a Nobel prize in 1950. In an extension of the use of chlorinated cyclopentadiene in this reaction, a series of compounds of extreme insecticidal potency was discovered. Two are already on the market, and are known as **aldrin** and **dieldrin** (HEOD) and two, **endrin** and **isodrin** are now in the experimental stage of development. In amounts as low as 4 to 8 oz. per acre, these compounds have been found effective for the control of soil insects such as wireworms and cutworms and they are of high promise for use against locusts and grasshoppers. Compounds so toxic to insects are perhaps unlikely to be harmless to human beings and stock. Although neither compound is particularly poisonous when ingested in a single dose, all four are suspected to be dangerous by prolonged skin contact or by the continued ingestion of low amounts. It is reassuring that a careful medical scrutiny of the workers engaged in the manufacture of these four insecticides has revealed no damage to their health but, until it is certain that the risks are negligible, it is wiser to keep these compounds away from contact with food.

In spite of extensive work, little is yet known of the way in which these chlorinated hydrocarbons produce their characteristic reactions on insects. They can all be grouped as nerve poisons for their effect is due to the interference of transmission of the nerve impulses so drastic that muscular coordination is completely upset and the insect is just unable to live. Naturally insects, even of the same species, differ in their susceptibility to this action and if those more resistant impart this quality to their offspring, the continued use of these insecticides will eventually result in the selection of the more resistant types. Unhappily, this result appeared quite rapidly, particularly with house flies and lice, in the history of DDT, and already, in many parts of the world, the use of DDT has been temporarily abandoned because it no longer has its earlier capacity to kill the insects. Fortunately, when no longer exposed to DDT, the progeny of the resistant strain more or less rapidly lose their resistance. In the meanwhile, however, alternative methods of control, both chemical and methods based on hygiene, must be used. Sanitary precautions, such as care in the disposal of refuse, were often neglected in the few years that DDT was so effective in reducing the fly population but, to folk who have for the first time experienced comparative freedom from this pest, a return to higher standards of cleanliness should need little encouragement.

Organo-Phosphorus Compounds

The ignorance which still hampers the full use of chlorinated hydrocarbons in insect control is less embarrassing in the case of a broad group of insecticides which are all organo–phosphorus compounds. It is now established that these compounds are toxic to warm-blooded animals because they prevent the action of an important group of enzymes, the cholinesterases, whose function is to destroy acetylcholine, the compound released at the nerve endings and which is responsible for the transmission of nerve impulses across the synapses and neuromuscular junctions. If these enzymes fail, the continued presence of acetylcholine disrupts muscular activity and death follows. The

level of the cholinesterase, in blood for example, can be measured fairly easily and its reduction to critical limits is an indication of a dangerous exposure to these phosphorus compounds. Blood assays thus provide a safety measure of great value in the protection of those who, like spray operators or pilots engaged in aerial application, come into long contact with this group of insecticides.

The first of the group to be used as an insecticide was tetraethyl pyrophosphate, better known by the initials **TEPP,** one of the most potent cholinesterase inhibitors known yet which is decomposed by water to a harmless compound so rapidly that it leaves no poisonous residue. A slight change in its molecular build–up, the replacement of the ethoxy groups by dimethylamino groups, gives **schradan,** also known as octamethylpyrophosphoramide or OMPA. This compound is readily soluble in water but its solutions are stable and have little inhibitory effect on cholinesterase. But in the animal, and at a slower rate in the plant, schradan is converted to a potent cholinesterase inhibitor which is also rapidly decomposed by water. Plants which are treated with schradan solutions take up the chemical and become toxic to sap–feeding insects, yet harmless to those insects which eat the treated leaves or which prey on the sap–feeding insects. Why schradan should be selectively insecticidal in this fashion is not known with certainty but the latest work indicates that all insects are able to convert schradan to an active esterase inhibitor but that, in the resistant species, this compound is decomposed by water before it can reach the enzyme within the nervous tissue of the insect.

The interplay of these reactions which lead to conversion by the organism to an active inhibitor and decomposition by water to harmless products, fosters the thought that in this group there are to be found compounds which are effective insecticides yet harmless to man and stock. **Parathion,** diethyl *p*–nitrophenyl thiophosphate, tends towards this ideal and being stable to water has a useful residual activity. The pure compound is not a potent inhibitor of the cholinesterases but it is readily converted to one by both insect and mammal leading to poisonous properties which render it unsuitable for general insecticidal use. A more recent discovery is **malathon,** another thiophosphate, which, unlike parathion, is itself an active inhibitor, is almost as toxic to insects as parathion yet which is about one hundred times less poisonous to warm–blooded animals. Malathon is considered safe enough for use against flies in locations where there is no frequent exposure to man or stock, though protective precautions must be taken by those engaged in its application.

Synthetic Pyrethrin-like Compounds

The closest approach yet to insecticides harmless to warm–blooded animals is the pyrethrin group. The flowers of pyrethrum (*Chrysanthemum cineraefolium*) contain at least four compounds which are powerful insecticides remarkable for their extremely rapid paralytic action on flies. Within the past three or four years, a compound **allethrin,** closely akin to these compounds, has been produced synthetically. More recently another synthetic analogue of the pyrethrins has been produced by a Japanese group of workers and this has been christened **furethrin.** Both allethrin and furethrin are perhaps somewhat less potent insecticides than the natural pyrethrins, but being more stable on exposure to air and sunlight, may prove to leave residues of more lasting effectiveness. But all are at the moment somewhat too expensive except for use when non–poisonous residues are essential. Fortunately it has been found that certain compounds possess the property of enhancing the insecticidal potency of the pyrethrins though not themselves being highly toxic. **Sesamin** is the oldest and best known of these so–called pyrethrin synergists but many others are now commercially available. The explanation of this synergistic action appears to be that flies have the ability to detoxify the pyrethrins by an enzymatic process which is inhibited by the synergist. When more is known of this mechanism, the way will be opened to the manufacture of other pyrethrin–like compounds which the insect is unable to detoxify and which may therefore be even more effective than the known compounds of this group.

Carbamates

The final and most recently discovered group of insecticides to be discussed are the carbamate series, the products of a remarkable series of investigations by H. Gysin and his colleagues of the J. R. Geigy S. A. from whose laboratories the insecticidal activity of DDT was first announced. This group of workers was searching for an insect repellent and had found that dimethyl dihydroresorcinol diethyl carbamate had such properties; substitution of the ethyl by methyl groups gave, to their surprise, a compound "**Dimetan**" with hardly any repellent action but which was highly toxic to flies, even to strains of the latter which were resistant to DDT. By further variation of the substituents of this compound, a number of other compounds were produced of possible value, some as acaricides, some as systemic insecticides of the type already described in schradan, and some as components of fly sprays. "**Pyrolan**" (a pyrazolyl dimethylcarbamate) proved more deadly than Dimetan to flies but, unfortunately, is of greater toxicity to warm-blooded animals. On the other hand, "**Propamat**", a substituent of pyrimidyl dimethylcarbamate, was sufficiently harmless to warmblooded animals to warrant trial in household fly sprays.

Conclusions

Every month now sees the discovery of yet further series of insecticides; yesterday, for example, came the report of the high activity of the chlorinated dioxanes. From those already available and from those to be discovered, experience will soon select the better and, with knowledge of their peculiarities and activity, the synthetic chemist will enable the entomologist to attain a complete control of the insect-borne diseases of man and of stock and of the insect pests of crops.

Lowland Rice Culture as an Economic Control of Sclerotinia and Root-Knot Nematodes

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THE growing of lowland rice in rotation with vegetable crops has been suggested by the Florida Agricultural Experiment Station, as a possible economic means of reducing losses from *Sclerotinia sclerotiorum* (Lib.) D By. and root-knot nematodes (*Meloidogyne*) in the Everglades region of Florida because of the prolonged flooding employed in rice culture.

In recent years the *Sclerotinia* has become a serious problem in the Everglades truck crop region. Attempts at control by spraying with fungicides failed. Application of 1,000 to 2,000 pounds of cyanamide per acre each year was partially effective but was not economical since control was not complete and the nitrogen liberated by the cyanamide was not needed on the mucklands. Under static flooding (holding water continuously at a given level) the sclerotia were decomposed in about six weeks, but flooding too was not economically feasible as a standard annual practice for the sole purpose of controlling the fungus.

Investigations in different regions indicate that flooding can also control root-knot nematodes. Although complete eradication takes a year or more, the nematode population can be reduced considerably with flooding in a period as short as two months.

The farming conditions of the truck crop area in the Everglades are conducive to the use of flooding as a control measure. The existing extensive drainage systems require little modification to maintain selected fields under flood. Abundance of water from the close of the vegetable-growing season in June until late September is an added advantage.

Benefits of Growing Rice

From all of the evidence it seems that flooding offers a good possibility of control and that rice growing will make the practice pay for itself. The cost of static flooding of typical vegetable land in the Everglades for the six weeks necessary for control averages $ 2.50 per acre[1]. Flooding of a rice crop for approximately 90 days would cost about twice as much but a profit could be expected. In 1952 the market price for short grain rough rice was $ 6.25 to $ 6.35 per 100 pounds and the average yield per acre in the South was 2,240 pounds. Thus this past year a grower could have grossed $ 140 per acre with a net return of perhaps $ 50.

In addition to its value as a cash crop, rice possesses other possible advantages for the Everglades. Flooding would control certain weeds and perhaps other soil-borne organisms besides *Sclerotinia* and root-knot nematodes. On mucklands, drainage and accompanying oxidation are reported to cause the loss of about one-tenth of a foot of soil annually. Rice culture would maintain a high water table in summer and could counteract some of the subsidence. Production of a small grain in the off-season for vegetables would increase agricultural stability and mill by-products would furnish much needed supplementary cattle feed. Little additional fertilizer would be necessary since residuals from vegetable growing are sufficiently high to supply the requirements of rice. Finally, a grower could use the second-cut crop for pasture if winter conditions warranted or let it mature for grain in the spring.

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[1] Cost figures are based on water handling alone and assume a 1- to 2-foot water table with fields not more than one foot out of level. Initial cost of diking, ditch blocking, and setting of pumps would be $ 5 per acre, but this cost would drop to 50 cents per acre in succeeding years. Depreciation of pumps is included. Estimates were derived from 1952 costs.

The Everglades Experiment Station and the United States Department of Agriculture started cooperative experiments in the spring of 1950, to determine whether lowland rice culture would be as effective as static flooding in decomposing the sclerotia of the fungus and reducing the population of the nematode, and whether lowland rice could be grown on the organic soils of the area.

Pilot Experiments on Sclerotinia in 1950

Two paddies were located on Everglades peaty muck soil 100 yards apart in the same field at the Everglades Experiment Station. Dikes were erected and one plot for lowland rice was fitted with a flume and floodgate for controlled flooding. The other was prepared for planting upland rice. On 12 May five–week–old rice plants, grown in the greenhouse, were set in both plots in rows one foot apart at one foot intervals. Overhead irrigation was used until the plants were well established.

Light wooden frames one foot square with plastic screen tacked on one side were used for holding sclerotia in place. One hundred sclerotia were distributed in each frame and another piece of screen was placed over the top to prevent loss of the sclerotia. These frames were buried 3 inches deep in both paddies. They were removed at intervals, and the sclerotia were counted and rated on the basis of percent decomposition and consistency of the remaining core. Those retaining size and shape and a firm texture were considered unaffected. Sclerotia with half their original bulk and a rubberoid consistency were rated half–rotted; those consisting of a fragment one–quarter the original size and not soft enough to smash with medium pressure of fingers were rated three–fourths rotted. Completely rotted sclerotia were identified by their outlines on the screen and masses of slime. Previous laboratory tests had indicated that sclerotia remain viable until approximately half decomposed.

The lowland paddy was flooded with moving water to an average depth of four inches from 10 June until 15 August, except for two separate days toward the end of the test, when the water level fell due to pump failure. The floodgate discharge was 9.7 gallons per minute. The upland paddy was given the same treatment but was not flooded.

On 9 June, eight frames of sclerotia were buried in each paddy. First counts made on 20 June on a frame from each paddy showed that only 4 of the 100 sclerotia in the upland paddy just began to decompose. Closer examination showed that these four were originally sclerotial fragments. On the other hand, 59 sclerotia of the 100 from the lowland paddy, subjected to ten days of dynamic flooding, were in various stages of decay. This was a large number in view of previous reports that a minimum of 35 days of static flooding was required for complete decomposition. On 27 June, 85 of the 100 sclerotia in the second frame from the upland paddy were unaffected, while 91 sclerotia from the lowland paddy were completely rotted and the 9 remaining were more than three–fourths rotted, i. e., only small cores were still solid after seventeen days of dynamic flooding. Because of this rapid deterioration five of the last six screens in both paddies were removed and examined the next day. Of the original 500, 415 sclerotia were unaffected in the upland paddy, 68 were beginning to rot, and 17 were completely rotted. The completely rotted sclerotia in this series were apparently fragments instead of whole sclerotia as in the first frame examined on 20 June. Only 25 sclerotia of the 500 taken from the lowland paddy were not completely rotted; of these 16 were three–fourths rotted and 9 were half–rotted.

To determine the viability of sclerotia taken from each paddy on 28 June, 25 unaffected sclerotia from upland paddy selected at random and the 25 partially rotted from the lowland paddy were washed in distilled water, and plated on potato–dextrose agar. Twenty five sclerotia from the original supply were also plated as a check. By 1 July all 25 sclerotia from the upland paddy had germinated, and 4 of the 9 half–rotted sclerotia from the lowland paddy showed weak germination. Ten days later the 25 check sclerotia had germinated normally, but none of the three–fourths–rotted sclerotia from the lowland paddy produced any growth. Repeated plating of sclerotia three–fourths or more rotted in further trials

Table 1. – *Decomposition of buried sclerotia of Sclerotinia sclerotiorum under circulating flood water in lowland rice culture, Belle Glade, Florida, 1951*

Date of counting	Number of days after burying	Number of sclerotia (a)			
		Unaffected	Half-rotted	Three fourths rotted	Completely rotted
First Hillsboro Plantation Trial					
May 23	8	78	11	0	11
26	11	32	40	0	8
30	15	8	13	17	62
31	16	6	16	17	61
June 2	18	3	4	11	81
3	19	1	2	13	84
4	20	0	2	5	93
5	21	0	0	2	97
Second Hillsboro Plantation Trial					
June 13	8	82	5	6	7
15	10	69	10	6	15
17	12	35	11	9	41
19	14	23	8	12	58
20	15	17	7	10	66
21	16	8	5	8	79
22	17	8	4	7	81
25	20	6	1	5	87
Hillsboro Commercial Planting Trial					
August 24	8	20	13	14	53
25	9	20	14	15	52
26	10	5	5	9	80
27	11	2	3	8	87
28	12	0	2	4	94
29	13	0	2	1	97
30	14	0	0	1	99
31	15	0	0	0	100
September 1	16	0	0	0	100
3	18	0	0	0	100

(a) Average of five replicates containing 100 sclerotia each buried three inches below the soil surface.

confirmed that sclerotia in this state of decomposition are not viable.

The last frame of this pilot experiment was removed from the paddies on 1 July. The frame from the upland paddy contained 88 unaffected, 6 half–rotted, 3 three–fourths –rotted, and 3 completely disintegrated sclerotia, whereas all sclerotia in the frame from the lowland paddy were rotted. Thus the sclerotia under dynamic flooding were destroyed in 20 days, about half the time necessary for complete disintegration under static flooding.

1951 Experiments with Sclerotinia

In February of 1951, rice was planted on 160 acres of the Hillsboro plantation near Belle Glade, Florida. Germination was good, but the young plants soon began to

die and the planting was abandoned. Experiments on the same land to determine the cause of this failure afforded an opportunity for further trials on the effectiveness of dynamic flooding in decomposing the sclerotia of *Sclerotinia sclerotiorum*.

Eight frames containing 100 sclerotia each, handled as in the pilot experiments, were buried in each of five separate paddies on 9 May 1951. This first replicated trial was to be under continuous flooding, but cultural operations and pump breakdowns interrupted flooding during the initial stage. Paddy 5 could not be flooded until after flooding was started in paddies 1 to 4. Consequently the counts of paddy 5 lagged although they did follow the general pattern of the other four. Water was started onto paddies 1 to 4 on 16 May for complete coverage for 24 hours. The water level dropped on 17 May and then water was applied 12 hours a day for the next three days. From 21 May to the end of the counts all five paddies were maintained under continuous flooding. The results of examining sclerotia in the buried frames at different dates are given in Table 1, under First Hillsboro Plantation Trial. This test was completed on 5 June so that, counting the first week of intermittent flooding, the sclerotia were completely decomposed in 20 days.

A second trial was started on the Hillsboro Plantation on 5 June and carried to completion under continuous flooding. Counts were made from 13 to 25 June at one–to two–day intervals. Table 1, under Second Hillsboro Plantation Trial, shows the results of this experiment. Again decomposition of the sclerotia was complete for all practical purposes in 20 days. Paddy 5 was located higher than the others and could not be satisfactorily flooded to the three–inch depth. That the sclerotia buried in this paddy did not rot so rapidly as those from the other four paddies accounts for the lower averages given as completely rotted in the closing days of the trial. Throughout this experiment over 90 percent of check sclerotia, which were buried in a maize field 200 yards from the paddies, were found to be viable.

A chance for a field trial was afforded in an 80 acre commercial rice planting on the Hillsboro Plantation in the late summer of 1951. Fifty screens of sclerotia were buried in the field on 6 August. The field was flooded from 17 August until the end of the trial, except for four days during which water was removed. Average sclerotial counts are given in Table 1 under Hillsboro Commercial Planting Trial. Even with four days without flood water the sclerotia were completely rotted in 18 days.

Table 2. – *Root–knot infection on three successive crops following rice in infested field, Belle Glade, Florida, 1950–52*

Crop following rice	Plot	Number of samples rating (a)					Average rating (a)
		0	1	2	3	4	
Pascal celery (1st planting)	Lowland (flooded)	13	37	0	0	0	0.7
	Upland (not flooded)	0	9	22	19	0	2.0
Black Valentine beans (2nd planting)	Lowland	23	19	6	1	1	0.8
	Upland	7	0	7	12	24	2.3
Pascal celery (3rd planting)	Lowland	0	0	0	17	33	3.7
	Upland	0	0	3	39	8	3.1

(a) The rating was made in accordance with an index of infection, with 0 indicating no gall formation and 4 severe infection. Fifty samples were examined from each plot.

Of the 500 sclerotia examined, two fragments were left on 31 August and one on 1 September. On 3 September all were completely rotted. Consequently the averages in the table show complete destruction on these three days.

Experiments on Nematode Control

Two plots, one for lowland paddy and the other for upland paddy, each 25 feet square, on well–decomposed Everglades peat, were diked and prepared for the trial. Thirty pounds of chopped roots of beans and squash, heavily infested with the root–knot nematode, *Meloidogyne incognita* (Kofoid & White), and 4.5 pounds of sclerotia of *Sclerotinia sclerotiorum* were spaded into the upper six inches of soil of both plots on 26 April 1950. On 12 May five–week–old rice seedlings were transplanted into the plots in rows six inches apart. Both plots were irrigated intermittently with sprinklers until 10 June. From that date to 15 August the lowland plot was flooded to a depth of four inches[2]. The upland plot was not flooded except for two periods of 24 hours each during which pump failure permitted the water level to fall. The total period of inundation was 66 days.

The rice in both plots matured normally, with the lowland plot yielding higher. The rice stubble in both plots was pulled by hand on 20 November in order to prepare the land for the next crop as soon as possible. The soil from the stubble was shaken back onto the plots.

Pascal celery was transplanted to the plots on 13 January 1951, and on 13 May ten plants were selected at random from every other row of the two plots and rated for severity of nematode infestation by an arbitrary index, in which 0 represents no galls and 4 severe galling. The results are given in Table 2.

Two additional test plantings of vegetables were made to determine how long there would be a continuous difference of infestation on successive crops planted in the two plots. On 20 November 1951 Black Valentine beans were planted to replace an earlier bean planting destroyed by frost. The roots of these beans were examined on 12 February 1952. The third crop was again celery, transplanted on 19 February and examined for root–knot infestation on 17 June. From the results given in Table 2, it will be seen that beans grown in the flooded plot still had a lower infestation than those in the unflooded, but the infestation of celery, the third crop following rice, was equally severe in both plots.

Summary and Conclusions

Repeated experiments have shown that the sclerotia of *Sclerotinia sclerotiorum* can be completely destroyed in field soil in the Everglades under the cultural practices employed in lowland rice culture during the summer. Decomposition is complete in 20 days in contrast to a minimum of 35 days necessary in static flooding. The quick, thorough destruction of the sclerotia indicates that a rotation program including the growing of lowland rice in summer on infested high–value vegetable land may offer an economical means for control of *Sclerotinia* in the Everglades.

Observations indicate that infestations of root–knot nematodes on peat soils may also be reduced by such a rice–vegetable rotation.

The influence of at least three factors needs study before the practice can be recommended to growers for limited trial. First, the effect of flooding with free–flowing water as used in this trial, may be different from the effect of the stagnant pools which might be established if large fields were flooded. Second, the use of water of high pH to flood fields may raise the soil pH in in the field to undesirable levels. The pathogenicity of different species of root–knot nematodes to commercial varieties of rice is not clear at present, but these nematodes have not so far been found to be of economic importance in rice culture in the United States. The most common species in the Southeast is *Meloidogyne incognita* (Kofoid & White).

[2] Ditch water was pumped into the lowland plot through a pipe to a flume from which it flowed down on splash boards and onto the west side of the plot. A gate with a sliding panel allowed a constant flow off the plot, from the east side. The rate of flow at this gate was determined to be 9.7 gallons per minute.

Outbreaks and New Records

Italy

Plant Protection Service, Ministry of Agriculture, Rome

New Record

Lucerne beetle. *Phytodecta fornicata* Brüggm. was recently discovered at Bonisiolo of Mogliano Veneto, Treviso Province, in the northeast of the country. This beetle was known previously to occur in several countries in central and southeastern Europe, such as Bulgaria, Hungary, Yugoslavia and Czechoslovakia. It attacks forage legumes, especially alfalfa.

Epidemic Outbreaks

Crane fly. Numerous larvae of *Tipula oleracea* L. were found in the gardens and fields in the region of Polesine (Rovigo). This insect occurs all over Europe and is especially serious in the southern countries. It damages many herbaceous plants, feeding on the roots of garden plants, vegetables, forage legumes, cereals and ornamentals. In severe outbreaks, it may destroy entire seedbeds of rice, necessitating resowing.

Artichoke cassid. Considerable infestation of *Cassida deflorata* Suffr. was found in artichoke fields on the coast of the Province of Ionio (Taranto). When the insect becomes numerous, young artichoke plants may be completely destroyed, but even mature plants are often greatly damaged. It occurs commonly in southern Europe and North Africa, and is particularly prevalent in central and southern Italy and on the Islands.

Lacebug on fruit trees. *Monosteira* (*Monanthia*) *unicostata* M. R. was found infesting almond and cherry trees in Bisceglie in Bari Province. This is a southern species, the usual hosts of which are poplar and willow.

Carnation rust. Severe outbreaks of carnation rust, *Uromyces caryophyllinus* (Schr.) Wint., occurred on the Ligurian Riviera, where carnations are grown extensively. Among fungicides tested in experimental trials, zineb (zinc ethylene bisdithiocarbamate) under the trade name of Dithane Z–78, used as a 3 percent spray at intervals of 20 days from the end of June to November, proved to be most effective. This fungicide leaves no residue on the treated plants which appear entirely clean.

Powdery mildew of tobacco. Frequent outbreaks of the powdery mildew (*Erysiphe cichoracearum* DC.) have been reported from a number of scattered tobacco fields. In experiments for the prevention of this disease carried out in the glasshouse, excellent results were obtained with two sprays of salicylanilide applied at the rate of 0.4 percent at an interval of 20 days. Application of thiram (tetramethyl thiuram disulphide) also gave some protection of the plants, but was less effective than salicylanilide and sulphur. Sulphur, in order to obtain effective control, must be applied at very high concentrations.

United States

Bureau of Entomology and Plant Quarantine,
United States Department of Agricultore

Occurrence of Alfalfa Plant Bug in Eastern States

The alfalfa plant bug (*Adelphocoris lineolatus* (Goeze)), which was first recorded in the United States in the State of Iowa in 1929, has now been found in the States of Delaware and Maryland. Surveys showed that this pest was infesting alfalfa throughout the northern half of the State of Delaware. Specimens collected from alfalfa 13 July, 1953, constituted Maryland's first official record of this pest.

Further Spread of Tomato Russet Mite

Tomato russet mite (*Vasates destructor* (Keif.)), which was found in several eastern states for the first time in 1952 (see FAO Plant Prot. Bull. 1 : 75 . 1952), has been discovered in the States of Delaware and Maryland. The pest was first recorded in Delaware in a greenhouse 29 May, 1953, and a local infestation in field tomatoes was reported 12 August. The first known occurrence of this mite in Maryland was recorded from field tomatoes in two counties during July. Damaging local infestations have since been reported over a wide area of the State. The States of New Jersey, Pennsylvania, Illinois, and Iowa have also had local infestations this year.

TITLES SELECTED

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The desert locust situation
Potato blight in Chile
Progress in plant protection in India

No. 2.

The locust problem in Central America and Mexico
Pineapple diseases and pests in Mexico
Insect problems in Nicaragua

No. 3.

The migratory locust in South America
Plant disease situation in the United States
Two important tree borers in Israel

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Disease outbreaks on economic plants in Italy
Major pests of crops in Afghanistan
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International Plant Protection Convention: its history, objectives and present status
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Some diseases of economic plants in Bihar, India
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Insects and diseases affecting some crops in El Salvador

No. 11.

Insect pests in British Colonial Dependencies; a half yearly report
Pests of edible legumes in Chile
A new white grub on apple in Israel

The sections "Outbreaks and New Records" and "Plant Quarantine Announcements" which appear in each issue contain information on the incidence and spread of destructive plant pests and diseases, and most recent plant quarantine regulations, covering wide geographic range.

FROM PREVIOUS ISSUES

PLANT QUARANTINE ANNOUNCEMENTS

Denmark - a correction

Regulations concerning the importation of plants, parts of plants, etc., dated 27 April 1953, were reviewed in this Bulletin 1 : 158–159. In the review listed under "Prohibited imports" were: "Oak (*Quercus* spp.) and Chinese chestnut (*Castanea mollissima*), including seeds." This should be corrected to read as follows: "Oak (*Quercus* spp.) seeds of all varieties; Chinese chestnut (*Castanea mollissima*) plants, including seeds. Seeds of European origin may be exempted from the prohibition."

New Zealand

The Plant Quarantine Regulations 1952, Amendment No. 1, which came into force on 30 July 1953, amends the provisions of the principal regulations relating to the importation of flower seed, the treatment of plants held in quarantine and inspection fees.

Under this Amendment, the introduction of flower seed is excepted from the requirement of a health certificate. Nursery stock held in quarantine may be grafted or budded, but shall not be further propagated without the written consent of an inspector. The scale of fees for treatment and inspection of imported plant materials is modified and a Schedule is set out in the Amendment to replace the Third Schedule to the principal regulations relating to this subject.

United Kingdom

The Importation of Plants (General Licence) (Amendment) Order, 1953, which came into effect on 5 August, amends the Importation of Plants (General Licence) Order, 1953 (See FAO Plant Prot. Bull. 1: 124. 1953). The Order, which relates only to imports from Europe, the United States and Canada, adds *Hedera canariensis*, rooted dahlia cuttings grown under glass and cider apples to the produce which may be imported under restrictions.

Under this Order, plants of *H. canariensis* and rooted dahlia cuttings grown under glass may be landed throughout the year if accompanied by a health certificate and a Form B certificate, in forms prescribed in the Importation of Plants Order of 1947 as amended. Cider apples, which by the Importation of Plants Order of 1947 should be accompanied by Form A (Colorado beetle) certificate during the period 1 April–15 October, require instead during the same period a modified certificate in the form set out in the present Order.

United States

Administrative instructions: list of approved packing materials and instructions for their use (Code 319.37–16 *a*) was amended effective 24 July 1953. This amendment reauthorizes the use of subsoil from Japan as a packing material for lily bulbs.

Since 1949, untreated subsoil from Japan had been prohibited entry into the United States, because such finely textured soil, when packed around bulbs, made it difficult to inspect the bulbs for infestation with *Phyllobrotica* spp. and certain other insects. Other materials used as substitutes of the subsoil, however, had not proved satisfactory. The use of Japanese subsoil as a packing material is therefore reauthorized, provided it has been dug from a depth of 2 ft. below the soil surface, sifted, dried and stored so as to prevent contamination with insects and plant diseases, and treated with an insecticide approved by the Chief of the Bureau of Entomology and Plant Quarantine and so certified by Japanese plant quarantine officials.

Other approved packing materials which remain unchanged include:

Buckwheat hulls	Ground cork
Charcoal, whenever desirable	Ground peat
Coral sand from Bermuda	Sawdust
Excelsior	Shavings
Exfoliated vermiculite	Sphagnum moss

NEWS AND NOTES

Canada and Egypt Ratify International Plant Protection Convention

The Governments of Canada and Egypt, whose representatives signed the International Plant Protection Convention on 6 December 1951, deposited the instruments of ratification with the Director-General of FAO on 10 and 22 July 1953, respectively. This brings the number of countries contracting to the Convention to seventeen, namely, Australia, Austria, Belgium, Cambodia, Canada, Ceylon, Chile, Denmark, the Dominican Republic, Egypt, El Salvador, India, Indonesia, Japan, New Zealand, Spain and Sweden.

Major Pests and Diseases in Western Europe and Mediterranean Region in 1952

The European Plant Protection Organisation made enquiries of its member Government on the incidence of several important plant pests and diseases in 1952. The following is a brief summary of the information which the European Organisation has circulated.

Potato root eelworm. During 1952 potato root eelworm (*Heterodera rostochiensis*) was recorded in most Western European countries and was found for the first time in Spain and the Saar. Norway, Iceland, Luxembourg, Italy, Yugoslavia, Portugal, Turkey, Israel, Tunisia, Algeria and Malta remained free.

In Sweden 281 localities were known to be infested including 21 outbreaks discovered in 1952. The main centres of infestation are in the coastal provinces of Skane, Blekinge and Halland, where potatoes are grown intensively. In Finland, only four outbreaks were reported, all at the southwestern end of the country. In Denmark, out of 35,000 samples taken in the winter of 1951–52 from fields planted with certified seed potatoes, only 0.2 percent were infested. In the Netherlands there was some spread of infestation around the existing centres in the province of Overijissel and near industrial areas. In the United Kingdom, there has been no major change in the distribution of the nematode in recent years, except that in 1952 the nematode was found in eastern Scotland. In Scotland, compulsory soil sampling made in 1951–52 in the fields of high-grade seed crop showed that out of 2,823 samples, only 118 contained cysts. In Northern Ireland, only 3 percent of the area surveyed in 1952 was found infested. In England and Wales the nematode exists in most parts of the country; sampling for infestation is compulsory for certain certified seed potato grades and for exported nursery stock. The Republic of Ireland was almost free from the pest which had been found only in a small number of isolated holdings and gardens. In Jersey, the main area of infestation remained on the south coast and in the extreme northwest of the island. Belgium had an infested area about 1 km. deep and 25 km. long along the coast. In France, infestation was still mainly confined to the regions of Dunkirk and Triel. The German Federal Republic continued in 1952 the systematic survey which revealed infestation in 2.5 percent of the 30,000 samples examined. Austria had only a few centers of infestation, still restricted to Salzburg, Styria and the Tyrol. In Spain the nematode was discovered in 1952 in the provinces of Barcelona and Valencia and on the island of Majorca, where imported seed had been grown.

In many countries where the nematode occurs, infested fields or whole areas have been placed under restrictions, prohibiting the growing of potatoes or tomatoes, adopting crop rotation, and limiting transport from infested fields. This pest is also a main object of quarantine action. Imported produce is usually rigidly inspected for the possible presence of the pest.

Potato wart. Potato wart disease (*Synchytrium endobioticum*) has not been recorded from Iceland, Channel Islands, Luxembourg, the Saar, Spain, Algeria, Tunisia. Even in the infested countries, it is now generally regarded as of lesser importance owing to the increased growing of potato varieties immune to this disease. In Portugal there have been no outbreaks since 1944. In Belgium former outbreaks have all been exterminated. The disease had practically disappeared for several years in the Netherlands and Italy until 1952, when small outbreaks occurred again in the northern parts of both countries. In the Scandinavian countries, there were also a number of new outbreaks in 1952.

In most infested countries, potato wart is subject to strict quarantine restrictions. Usually only seed potatoes of immune varieties are permitted to be imported, and only immune varieties may be grown or replanted in the infested or protective zones. Movement from the infested areas is generally prohibited. In certain countries, such as the United Kingdom and Belgium,

growers are required by law to report every outbreak.

San José scale. In the areas covered by this survey, San José scale (*Aspidiotus perniciosus*) is known to exist only in central and southern continental Europe, and in Algeria. In the Netherlands, although it had been found on imported plants, this insect never became established. In the German Federal Republic, inspection and enquiries were carried out in orchards as well as in markets, covering 8,015 communes. As a result, over 700,000 trees were fumigated or destroyed. In Austria, the situation has not changed for many years, with main infestion areas confined to the eastern half of Lower Austria. In Italy, this insect was still important in the northern and central parts, with some extension geographically but in general a reduction in intensity. Portugal had some light infestation in 1952 in the previously free districts in the vicinity of Lourinha, Torres Vedras and Colares. In Yugoslavia, Spain and Algeria, the situation remained approximately the same as in 1951. Yugoslavia had about 13 million fruit trees affected mainly in the north of the Save river. Spain had only very light infestation. In Algeria, the Department of Algiers was still the most seriously infested zone.

San José scale is one of the major pests which non-infested countries have attempted to exclude through rigid quarantine measures. In the infested countries, intensive control programs, including fumigation and spraying, have been carried out.

Sugar beet yellows. Severe outbreaks of virus yellows in Denmark, the German Federal Republic and Austria during 1952 have caused heavy losses of the crop.

Oak wilt. Surveys made in 20 European countries revealed that oak wilt (*Chalara quercina*) is not present in those countries.

A Correction

Eriophyes hoheriae and *E. populnea* were reported as new pests in New Zealand, in this Bulletin Vol. 1, p. 30, 1952. The author, Mr. G. A. H. Helson, has just reported that *E. populnea* is a synonym of *E. hoheriae* as described by Lamb in 1952. The name therefore should be *E. hoheriae* Lamb.

Roma - Tip. del Senato del dott. Giovanni Bardi

CEREAL BREEDING PROCEDURES

Recently published, this FAO Development Paper covers the whole field from the hybridization of the parent plants until a new variety is in commercial production. Methods of growing hybrid populations, systems of testing and recording of results, variety purification and increase of pure seed, as well as the analysis of data, are treated in detail. Various types of nurseries are described for the breeding of varieties resistant to plant diseases and insect pests, and tolerant to certain climatic factors such as frost.

Special features of the publication are the sixteen appendices which graphically illustrate planting plans, plot arrangements, the statistical progress of a cross, variety purification and other features of a cereal breeding program. The complexity involved in modern plant breeding methods and the consequent necessity of systematizing the procedures are clearly and impressively indicated. 122 pages, $1.25; 6/3.

LEGUMES IN AGRICULTURE

This unique collection of information on legumes, edited by R. O. Whyte, G. Nilsson-Leissner and H. C. Trumble, required the collaboration of specialists in every member country of FAO. No fewer than 111 contributors are acknowledged, and contributions from many more are mentioned in the text.

Nowhere else is such information available in one volume and, by pointing to the limitations in the data on economic botany, ecology and the biotic relationships of legumes it is hoped to encourage further research and experiment particularly in tropical and sub-tropical areas. An appendix tabulates the species, indicating plant characteristics, climatic adaptation, soil adaptation, utilization, number of seeds per pound and seeding rates in pounds per acre. 368 pp., many illustrations, $ 3.00; 15s.

Bonzini 150
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